

# PAST AND PRESENT DISTRIBUTIONS OF GOLDEN PERCH *MACQUARIA AMBIGUA* (PISCES: PERCICHTHYIDAE) IN VIC- TORIA, WITH REFERENCE TO RELEASES OF HATCHERY- PRODUCED FRY

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**ABSTRACT:** Golden perch (*Macquaria ambigua*) is regarded as vulnerable in Victoria. Details of past and present (post-1975) distributions are presented. Data were derived from records of the Fisheries Division, Fisheries and Wildlife Officers, members of angling clubs and from surveys undertaken between 1982 and 1984. It appears that the range of golden perch has declined probably due to prevention of upstream migration of juveniles and adults by high-level weirs. Some populations persist below the weirs in lower sections of tributaries to the Murray River but these populations may be under threat from habitat alteration. The range of golden perch in Victoria has been extended by releases of hatchery-produced fry both by angling clubs and, since 1982, by Fisheries Division. Generally, fry have been stocked in rivers within the previous natural range of golden perch, such as above weirs built this century, but they have also been released in river basins outside their natural range in western Victoria.

Several species of native freshwater fish are regarded as vulnerable in Victoria (Cadwallader *et al.* 1984). The past and present distributions of three of these species have been recently documented: Macquarie perch (*Macquaria australasica*) (Cadwallader 1981), Murray cod (*Maccullochella peelii*) and trout cod (*Maccullochella macquariensis*) (Cadwallader & Gooley 1984). Golden perch, *Macquaria ambigua* (Richardson 1845) is also regarded as vulnerable in Victoria. *M. ambigua* occurs naturally in the Murray-Darling river system, the Lake Eyre and Bulloo drainage system and the easterly-flowing Dawson Fitzroy system in Queensland. MacDonald (1976) showed that the populations in the Murray-Darling drainage are morphometrically distinct from other populations. Within this system, adult golden perch migrate upstream to spawn, while pelagic eggs and larvae are liable to be swept downstream resulting in the mixing of golden perch throughout the system (Reynolds 1983). In Victoria, the natural range of golden perch extended throughout the lower elevations of tributaries of the Murray River (Cadwallader & Backhouse 1983) but its range and abundance has declined since European settlement (Cadwallader 1977, Cadwallader & Backhouse 1983). The species is now considered "vulnerable" in Victoria (Cadwallader *et al.* 1984).

The Warmwater Ecology Program (WEP) of the Fisheries Division, Victoria, was established to identify locations and habitats where golden perch populations could be augmented or re-established, with hatchery-produced fish. The first two tasks were to determine the present distribution of golden perch in Victoria and to assess the outcome of releases of fry by the Fisheries Division between 1982 and 1985. The fish were usually 6 to 8 weeks old when released and had been actively feeding in rearing ponds. In this paper I present results of surveys undertaken by WEP during 1982-84.

## METHODS

Information on the past distribution and translocations of golden perch was obtained from records of Fisheries Division, Victoria. Dates of sightings at locations given by Cadwallader and Backhouse (1983) were taken from summaries of Fisheries surveys (Tunbridge, personal communication).

Dates are provided for distribution records to enable comparisons with future assessment of present distributions to be made. For the purposes of this paper, "present" is considered to be post-1975. Information on sightings of golden perch in the last ten years came from four sources: (1) Fisheries records of surveys and releases and records of permits to release fry in private and public waters by non-government bodies were available up to 1982; (2) A questionnaire sent to all the above permit holders—this questionnaire sought information on the success of stockings and dates of recaptures; (3) A questionnaire sent to all Fisheries and Wildlife Officers asking for records of golden perch in waterbodies in their regions; and, (4) Confirmation of past records was made by surveys by WEP staff between October 1982 and May 1984. Thirty-four sites were surveyed to determine the distribution of inland fish species; golden perch was the target species at 20 of these sites. Results for all other species caught are given in Brumley *et al.* (in press); only dates of records are presented in the current paper.

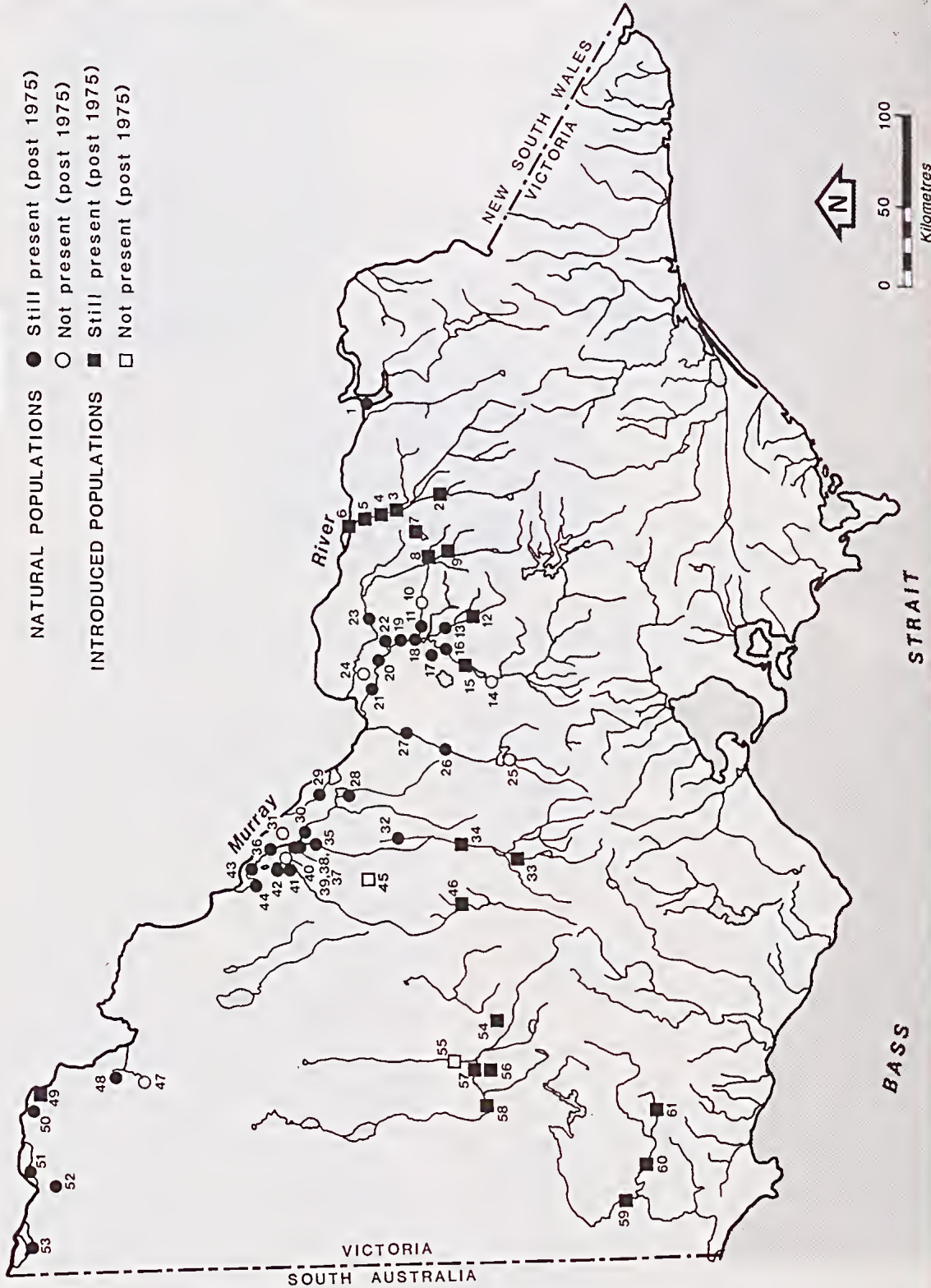
Contact was also made with many of the 103 individuals who were given permits to stock private dams with golden perch between 1973 and 1982. The success of these stockings often provided further information on survival of golden perch outside their natural range.

## RESULTS

The past and present distributions of natural and introduced populations of golden perch in Victoria are

### LEGEND

- NATURAL POPULATIONS** ● Still present (post 1975)  
 ○ Not present (post 1975)
- INTRODUCED POPULATIONS** ■ Still present (post 1975)  
 □ Not present (post 1975)



shown in Fig. 1. The past distribution (solid and open circles) extends further up each of the tributaries of the Murray River than the present distribution (solid circles and solid squares). Details of each record are given in Table 1. In several rivers, stocks have been replenished in the last ten years by introduction of hatchery-produced fry. In the Ovens River, reports of golden perch were all post 1982 and appear to be the result of survival and migration of fry released by N.S.W. State Fisheries between 1980 and 1982 into Lake Mulwala (site 6). This lake is regarded as the site of a former natural population (Cadwallader 1977). Releases of fry by the Fisheries Division, Victoria, into the Goulburn and Loddon River basins have possibly extended the natural distribution. Only in the Goulburn River (site 14) was historical information available to indicate that golden perch previously occurred close to the release site.

Details of releases of golden perch fry by the Fisheries Division between 1982 and 1984 are given by Brumley *et al.* (1987). The dates and sites of these releases, together with dates and sites of releases in 1985, are given in Table 1. In 1985 the Loddon River above Laanecoorie Weir (site 33), Lake Cardross (49) and Lake Cullulleraine (52) were stocked. Releases into the Wimmera and Glenelg River basins appear to have been successful and thus extend the distribution of golden perch beyond their natural range. Information on stockings by non-government groups was scarce. Only three angling clubs, out of ten, returned questionnaires (Table 1).

Adult specimens of golden perch had earlier been translocated into the Wimmera (site 57), Richardson (55) and Wannon rivers (60). Reports from the Horsliam Angling Club, indicate that translocated fish survived in the Wimmera River but not in the Richardson River. There were no reports of golden perch in the Wannon River until 1983 after fry were released.

From 1973 to 1982, 103 permits were issued to private individuals to stock farm dams with a total of 14,532 golden perch. Many fish survived in areas outside their recent range, e.g., Pakenham, Kilmany (La Trobe River basin), Mt. Clear (Barwon River basin) and several sites in the Wimmera River basin. Fry released by the Fisheries Division also survived in the Wimmera River. Fry were also released in Flowerdale (upper Goulburn River basin) which is upstream of the recent natural range in the Goulburn River (14). Survival of fish also occurred at Casterton in a dam that may be flooded by the Glenelg River (site 59) and at Nullawill, a site close to the Avoca River (46).

There was also survival from stockings into farm dams throughout the natural range of golden perch. These fry could have escaped into adjacent rivers during floods, e.g., the Ovens River at Chiltern, the Broken River at Warranbayne, and the Goulburn River at Toolamba.

## DISCUSSION

The present distribution of golden perch in Victoria appears to be similar to the past distribution with an extension into river basins in western Victoria. A decline

in the range of golden perch in the upper sections of Victorian tributaries of the Murray (Cadwallader & Backhouse 1983), appears to be partly rectified by releases of hatchery-produced fry. This decline had been attributed to both habitat degradation and lack of spawning in the upper reaches (Cadwallader 1978, Reynolds 1983). The habitat requirements of golden perch are not yet accurately defined but they appear to prefer warm, turbid, slow-flowing waters (Merrick & Schmida 1984). Therefore, they were unlikely to have occurred right up to the headwaters of the tributaries of the Murray River. The past range is similar to that shown by Cadwallader and Backhouse (1983), but old records are lacking to confirm this.

It is likely that golden perch occurred naturally in sections of rivers that are now above weirs. Although they were previously present, golden perch were not reported in Lake Mulwala and the Ovens River, above Yarrowonga Weir, after 1939 when construction of the weir was completed (Cadwallader 1977). A weir on the Goulburn River was built at Nagambie in 1920 and the last record of a natural population of golden perch at this site was 1922. Eppalock Weir on the Campaspe River was completed in 1962 and there are no recent records of golden perch. Golden perch have only been recorded from the lower reaches of the Loddon River. There is likely to be suitable habitat for golden perch upstream of Laanecoorie Weir which was first built in 1891 and extended in 1909. This barrier was present before records of fish populations were made.

Butcher (1967) recognised that impoundments would be detrimental to migratory fish. Llewellyn (1968) reported that golden perch moved long distances in rivers in N.S.W. Reynolds (1983) reported that mature golden perch, tagged in the Murray River near the border of Victoria and South Australia, underwent an upstream spawning migration that was triggered by a rise in water level at the onset of major flooding. He proposed that this spawning strategy compensates for downstream displacement of eggs and young fish. He found that golden perch moved through regulatory weirs when the weirs were open during periods of high water but did not move as far up the Murray River as they did in the Murrumbidgee or Darling Rivers. None of the 3267 golden perch tagged in Reynolds' study were recaptured in Victorian tributaries. Golden perch probably use fish ladders along the Murrumbidgee River. The present lack of golden perch above high-level weirs in Victoria is likely to be due to the inability of adults to reach and spawn in the upper reaches of rivers. Low-level weirs across the lower reaches of Victorian tributaries, such as at Kerang on the Loddon River and at Rochester on the Campaspe River, may restrict upstream migration from the Murray River. In contrast, anabranches of the Murray River west of Mildura, which have no man-made barriers, have abundant natural populations of golden perch.

Possible causes of decline of golden perch have been discussed by Cadwallader (1978). Although stocks of golden perch have declined, there is a lack of evidence

Table 1: Details of 61 sites that have been known to contain golden perch in Victoria. Site numbers refer to the location of sites shown in Figure 1 where the status of the population is also depicted. Source of information comes from Fisheries Research staff: Baxter, Cadwallader, Hume, Rogan and Tunbridge; Fisheries Officers: Backhouse, Clements, Dickinson, Hasthorpe, Hosking, Jackson, Lang, May, Meakes; Fisheries and Wildlife (FW) records and files and from survey work from Shepparton by the Carp Program and Warmwater Ecology Program (WEP). Also from results of questionnaire to non government bodies that have released fry of golden perch. Dates for the source are also given as the most recent records. Unless otherwise indicated, 'Stocked' fish are fry released by Victorian Fisheries and Wildlife Service.

SITE NUMBER	SITE	LOCALITY	SOURCE OF INFORMATION AND DATE OF RECORD
1	Lake Hume	Tallangatta	Rogan 1970-1975
2	King River	Oxley	Tunbridge 1982; Lang 1983
3	Ovens River	downstream Wangaratta	Tunbridge 1982
4	Ovens River	Peechalba	WEP 1982; Cadwallader 1983; Lang 1982, 83, 84
5	Ovens River	upstream L. Muiwala	WEP 1984
6	Lake Muiwala	Yarrowonga	Lang 1983, 84; stocked by NSW Fisheries 1980, 81, 82
7	Lake Mokoan	8enalla	Stocked 1982; WEP 1983; Lang 1984
8	Stockyard Creek	Outlet of Lake Mokoan	Hosking 1983
9	Broken River	Lake 8enalla Weir	Lang 1983, 84; Stocked 1983, 84
10	Broken River	8enalla to Shepparton	No evidence of golden perch - Carp Program 1980, 81, 82
11	Broken River	Shepparton	Hosking 1983, 84
12	Seven Creeks	Euroa Weir	Stocked 1984, 85; WEP (angler report) 1984
13	Seven Creeks	below Euroa Weir	Cadwallader 1975-76 (published 1979); May 1984
14	Goulburn River	Nagambie Weir	FW Records 1922
15	Goulburn River	Nagambie Weir	Stocked Nagambie Angling Club 1983; Stocked 1984, 85; WEP (Nagambie Angling Club Competitions) 1983-84
16	Goulburn River	Nagambie to Shepparton	Meakes 1984
17	Goulburn River	Darcys State Forest, Toolamba	Carp Program 1980
	Billabong		
18	Goulburn River	Shepparton	Carp Program 1979, 80; WEP 1983, 84
19	Goulburn River	8unbartha	Carp Program 1982
20	Goulburn River	Udera	Carp Program 1982; WEP 1983
21	Goulburn River	McCoys to Stewarts Bridges	Cadwallader 1980; Carp Program 1980
22	Loch Garry	Bunbartha	Carp Program 1981
23	Broken Creek	Numurkah	Hosking 1983, 84
24	Wakiti Creek		Meakes (prior to 1975); no current evidence from Carp Program 1981
25	Campaspe River	Eppalock	Meakes (prior to 1975)
26	Campaspe River	English Bridge, Goornong	WEP (angler report) 1983
27	Campaspe River	Siphon at Waranga - Mallee channel	Meakes 1984
28	Kow Swamp	Gunbower	Dickinson 1983; Meakes, 1984; WEP 1984
29	Gunbower Creek	Cohuna	Dickinson 1980-84
30	Pyramid Creek	Kerang	Dickinson 1984
31	Murrabit River/ Barr Creek		(no current evidence) Dickinson 1984
32	Serpentine Creek		Dickinson 1984
33	Loddon River	above Laanecoorie Weir	Stocked 1985 (Clements, WEP)
34	Loddon River	Laanecoorie to Bridgewater.	Clements (angler report) 1980; stocked 1982, 83, 84; Dickinson 1984; Meakes 1985
35	Loddon River	Kerang	Stocked 1982, 83, 84, 85; WEP 1984, 85
36	Loddon River	Kerang Weir to Little Murray R.	Dickinson 1980-84; WEP 1985
37	Reedy Lake		WEP 1983
38	Middle Lake		Dickinson 1984
39	Third Lake		Dickinson probable
40	Lake Charm		No evidence of golden perch - WEP 1982, 83
41	Racecourse Lake		Hume 1980
42	Kangaroo Lake		Backhouse 1979; Carp Program 1980; WEP 1983
43	Little Murray River		WEP 1984
44	Lake 8oga		Dickinson probably (1982)
45	Little 8oort Lake		Stocked 1982, drained 1983; WEP 1983
46	Avoca River		St Arnaud Angling Club 1980-84
47	Lake Mournpall	Hattah Lakes National Park	Baxter 1984 (lake dried)
48	Hattah Lakes		Backhouse 1979, 80
49	Lake Cardross		Stocked 1985
50	Lake Hawthorn		Carp Program 1979, 80
51	Walipoola Creek		Moy 1984; WEP 1984; Commercial FW records 1970-84
52	Lake Cuiullieraine		WEP 1984, stocked 1985
53	Lindsay River		Moy 1984; WEP 1984; Commercial FW records 1970-84
54	Cato Lake	Stawell	Stocked 1981 Stawell Apex Club
55	Richardson River	Donald	Donald Angling Club 1953, 55
56	Green Lake	Horsham	Stocked 1977, 78, 79 Horsham Angling Club; Stocked 1982, 83, 84, 85; Horsham Angling Club 1984; WEP 1983, 84
57	Wimmera River	Elmhurst to Horsham	Stocked 1949, 50, 55 Horsham Angling Club; stocked 1982, 83, 84, 85; WEP 1984
58	Wimmera River	Horsham to Dimboola	WEP (Horsham Angling Club) 1983, 84
59	Gleneig River	Casterton, Ess Lagoon	Stocked 1983, 84, 85; Hasthorpe 1983, 84
60	Wannon River	Tahara Bridge	Stocked 1922; Stocked 1983, 84, 85; Hasthorpe 1983
61	Lake Hamilton	Hamilton	Stocked 1983, 84, 85; Hasthorpe 1984; Jackson 1985

to show specifically how the species have been affected. Commercial records of "Murray fish", including golden perch, showed an overall decline in 1946-49, after thirty years of exploitation (Cadwallader 1978). Commercial fishing for golden perch in Victoria is now restricted to the Mildura region where catches averaged about 5000 kg per annum from 1976-77 to 1983-84 (Cadwallader 1985).

The range of golden perch in Victoria has expanded since 1975. Recent reports of golden perch in the Ovens River probably result from stockings of fry into Lake Mulwala by the N.S.W. State Fisheries (now Division of Fisheries, Department Agriculture, N.S.W.). A total of 285,900 golden perch fry were released into Lake Mulwala between 1979-80 and 1981-82 (Rowland *et al.* 1983). Catches of golden perch, up to 4 kg in weight, in the King and Ovens Rivers from 1982 onwards suggests an upstream migration of released fry. A survey in Lake Mulwala in 1984 revealed good growth rates of fry released in 1980-81 (up to 3 kg) and 1981-82 (1-1.2 kg) (Rowland, personal communication).

Releases by the Fisheries Division, Victoria, in the impoundment at Lake Mokoan, and above Benalla, Euroa and Nagambie weirs have re-established golden perch in the upper reaches of the Goulburn River basin. Natural populations have persisted in the lower reaches where there is unimpeded access to the Murray River. It appears that natural populations have declined in the Broken River (site 10) where several small weirs obstruct migration of fish during all but very high flood waters.

Releases of hatchery-produced fish has extended the range of golden perch into river systems west of the Loddon River. Most releases appear to have been successful with fish being recaptured after one or two years. However, the population in Little Boort Lake did not persist following the draining of the lake fourteen months after fry were stocked. The lake above Benalla Weir was drained in 1984 but fish from here could have moved upstream or downstream. The successful stockings of many private farm dams also indicate that golden perch survive well in these habitats outside their natural range.

Golden perch may be regarded as vulnerable in Victoria but it is widespread and abundant in other parts of the Murray-Darling basin (Reynolds 1983, Llewellyn 1983). It remains an important commercial species in New South Wales and South Australia, with catches ten to twenty times greater than Victoria (Cadwallader 1985). Releases of fry in public waters in New South Wales began with nearly 200,000 in three lakes in 1976-77 and has continued in impoundments each year (Rowland *et al.* 1983). In a workshop on endangered Australian inland fish species, organised by the Australian Society for Fish Biology (Melbourne, August 1985), golden perch was not categorised in the list of endangered or restricted species (J. Harris, personal communication).

However, in Victoria, the ultimate security of golden perch is not yet assured. The extended range of golden perch in Victoria is mainly due to releases of hatchery-produced fry. Until the reproductive success of such in-

roduced populations is determined, the long term survival of the species in Victoria is still in doubt. Also, the extent to which numbers of golden perch have declined due to alteration of micro-habitat in the lower reaches of rivers has not yet been determined. Future changes in flows, salinity levels and flood regimes in areas where golden perch appear to be common (lower Goulburn River and Kerang Lakes) may further decrease the abundance of this species. Further investigation of habitat requirements of golden perch is required. Until these aspects of golden perch biology are fully understood, *Macquaria ambigua* should be regarded as vulnerable (*sensu* Cadwallader *et al.* 1984) in Victoria. A continuation of stocking is recommended. However, to safeguard other native species, new areas south of the divide should not be stocked.

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